

WHAT WE CLAIM IS:

1. A scanning optical microscope comprising:  
a light source;  
a wavefront converting element for applying a  
5 desired wavefront conversion to illuminating light emitted  
from said light source;

an objective for collecting wavefront-converted  
illuminating light emerging from said wavefront converting  
element onto a sample;

10 a detector for detecting signal light emitted from  
said sample; and

an actuator for scanning said objective along a  
direction perpendicular to an optical axis.

2. A scanning optical microscope according to claim  
15 1, wherein when said actuator scans one section of the  
sample perpendicular to the optical axis with said  
objective, said wavefront converting element applies a  
constant wavefront conversion to said illuminating light.

3. A scanning optical microscope according to claim  
20 1 or 2, wherein when an amount of movement of said  
objective along a direction perpendicular to the optical  
axis is denoted by  $\Delta X$ , the following condition (1) is  
satisfied:

$$\Delta X \leq 0.66 f_{OB} \cdot \lambda / (\Delta Z \cdot NA^4) \quad \dots (1)$$

25 where:

$f_{OB}$ : a focal length of the objective;

$\Delta Z$ : an amount of focal point movement caused by  
the wavefront converting element;

$\lambda$  : a wavelength of the illuminating light;

NA: a numerical aperture of the objective.

4. A scanning optical microscope comprising:

a light source;

5 an optical element having a positive power for  
converting illuminating light emitted from said light  
source into a convergent beam;

a reflecting mirror with an aperture;

a reflection type wavefront converting element for  
10 applying a desired wavefront conversion to said  
illuminating light;

an objective for collecting said wavefront-converted  
illuminating light onto a sample; and

a detector for detecting signal light emitted from  
15 said sample.

5. A scanning optical microscope according to claim  
4, wherein an optical system including said reflecting  
mirror with an aperture satisfies the following condition  
(2):

20 
$$r_{Hmin}/r_{Minc} \leq 0.5 \qquad \dots (2)$$

where:

$r_{Hmin}$ : a minimum value of a length from an optical  
axis to a reflecting mirror edge;

$r_{Minc}$ : a radius of wavefront-converted illuminating  
25 light incident on the reflecting mirror with  
an aperture.

6. A scanning optical microscope comprising:

a light source;

an optical element having a positive power for converting illuminating light emitted from said light source into a convergent beam;

5 a reflecting mirror placed at a position where said convergent beam is collected;

a reflection type wavefront converting element for applying a desired wavefront conversion to said illuminating light;

10 an objective for collecting said wavefront-converted illuminating light onto a sample; and

a detector for detecting signal light emitted from said sample.

7. A scanning optical microscope according to claim 6, wherein an optical system including said reflecting  
15 mirror satisfies the following condition (3):

$$r_{\text{Mmin}}/r_{\text{Ainc}} \leq 0.5 \quad \dots (3)$$

where:

$r_{\text{Mmin}}$ : a minimum value of a length from an optical axis to a reflecting mirror edge;

20  $r_{\text{Ainc}}$ : a radius of wavefront-converted illuminating light at a position of the reflecting mirror.

8. A scanning optical microscope comprising:

a light source;

25 a reflection type wavefront converting element for applying a desired wavefront conversion to illuminating light emitted from said light source; and

an objective for collecting wavefront-converted illuminating light onto a sample;

wherein said light source also serves as a detector for detecting signal light emitted from said sample.

9. A scanning optical microscope comprising:

a light source;

5 a reflection type wavefront converting element for applying a desired wavefront conversion to illuminating light emitted from said light source;

an objective for collecting wavefront-converted illuminating light emerging from said wavefront converting  
10 element onto a sample; and

a detector for detecting signal light emitted from said sample;

wherein said reflection type wavefront converting element is placed in an optical path so as to satisfy the  
15 following condition (4):

$$\theta_{PR} \leq 50 \cdot NA^{-1} \sqrt{\lambda \cdot \Delta Z^{-1}} \quad \dots (4)$$

where:

$\theta_{PR}$ : an angle ( $^{\circ}$ ) of incidence of a principal ray on said wavefront converting element;

20  $\Delta Z$ : an amount of focal point movement;

$\lambda$  : a wavelength of said illuminating light;

$NA$ : a numerical aperture of said objective.

10. A scanning optical microscope comprising:

a light source;

25 a reflection type wavefront converting element for applying a wavefront conversion to illuminating light emitted from said light source;

an objective for collecting wavefront-converted

illuminating light emerging from said wavefront converting element onto a sample; and

a detector for detecting signal light emitted from said sample;

- 5 wherein a reflecting surface of said reflection type wavefront converting element is controllable into an aspherical toric surface configuration.